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PATENT SPECIFICATION

621,199

Convention Date (France): March 16, 1940.
Application Date (in United Kingdom): July 3, 1945. No. 16955/45.
Complete Specification Accepted: April 6, 1949.
(Under Section 6(1) (a) of the Patents &c. (Emergency) Act, 1939 the proviso to Section 91(4) of the Patents and Designs Acts, 1907 to 1942 became operative on July 3, 1945).

Index at acceptance:—Class 70, E12g.

COMPLETE SPECIFICATION

Improvements in or relating to the Vulcanisation of Rubber Articles

We, COMPAGNIE GENERALE D'ELECTRICITE, of 54, rue La Boëtie, Paris (Seine), France, a Limited Liability Company, organised under the Laws of France, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The study of the vulcanisation of a rubber article of great length such as, for instance, a sheath of rubber laid around a metallic cable when a certain amount of air or gas can remain in the rubber, shows that when the interior of the sheath to be vulcanised reaches a certain temperature an internal pressure is set up due to an increase in the temperature of the air or gases remaining in the rubber. As long as the sheath is in contact with the vulcanising means, which may consist of a fluid under high pressure such as steam, hot air, water or other vapours, gases or liquids, the internal pressure is counterbalanced and there is no noticeable deformation of the sheath. This is not the case, however, when the sheath, while vulcanised but still hot, leaves the vulcanising means which are under pressure to re-enter the free air, at atmospheric pressure. The difference which then exists between the pressure of the gases in the sheath and that of the atmosphere causes expansion of the sheath which may result in its bursting.

The object of the present invention is to provide a remedy for this inconvenience.

According to the present invention the vulcanised article is cooled on leaving the vulcanisation apparatus by means of a cooling fluid circulating under a pressure approximately equal to the pressure of the vulcanising fluid.

The pressure of the cooling fluid has to be approximately equal to the pressure of the vulcanising means so that, during the course of the cooling, the pressure of occluded gases is always adequately counterbalanced.

Any small difference in pressure one way or the other required by reason of the respective natures of the cooling and vulcanising fluids used is automatically obtained by means of a differential regulating apparatus.

The accompanying drawings show schematically by way of example only, one method of carrying out the process of continuous vulcanisation according to the invention, using water under pressure as the cooling fluid and live steam as the vulcanising fluid.

Fig. 1 represents a complete plant permitting the cooling of the rubber sheath of an electric cable, the sheath being treated by a continuous vulcanising process.

The cable indicated at 2, passes through the vulcanisation tube 1 of which only the end is shown. This tube is under the pressure of saturated steam. A tube section 3 is fixed to the tube 1, forming a prolongation thereof, by a flange 4. The tube 3 comprises a tubular part 5 with its axis vertical to form a condensation trap. The latter is emptied either directly through a pipe controlled by the valve 6, or by two steam traps 7 and 8, the operation of which is controlled by valves 9 and 10. A level-indicator 11 permits the detection of insufficient flow through the traps. A member 12 is attached to the tube section 3 by a flange 13. This member comprises two concentric tubes forming a labyrinth joint with chambers 14 and 15. The chamber 15 consists of cells separated from one another by diaphragms each of which, in its

centre, is provided with an aperture forming a passage for the cable 2, with a small clearance of from 0 to 2 mm.; these dimensions, however, are not to be regarded as limiting. At the region 16 the partition separating the chambers 14 and 15 is provided with holes allowing free communication between the two chambers. The chamber 14 is supplied with a cold liquid at a predetermined pressure, by a pipe 17 which is controlled by a stop-cock 18. A pipe 19 controlled by a valve 20 permits either the emptying of the chamber 14 or the establishment of a circulation through this chamber between the pipes 17 and 19. A telescopic tube 21 is adapted to be connected at one end to the member 12 by means of a joint 22 and at the other end to the tube 24 by means of a joint 23. Access to the member 12 and the cable 2 is made possible by moving the tube 21 in the direction of the arrow; it then overlaps the tube 24. The latter is covered over the greater part of its length by a chamber 25 in which a cold liquid at low pressure, preferably water, can be circulated. This liquid is admitted through the pipe 26, whilst emptying is performed through the pipe 27, the valve 28 permitting regulation of the supply. The tube 24 is supplied with liquid at a predetermined pressure through a pipe 45, which is controlled by a stop valve 29. The feed pressure in a supply header 30 is maintained at a predetermined value which is a function of the pressure of the vulcanising medium in the tube 1. This regulation is performed by a differential regulator 31 which will be described later. The cooling liquid, which is water in the present example, enters the regulator 31 through a pipe 32 at the maximum pressure which may be required. It leaves the apparatus at a predetermined pressure through the pipe 33 which is connected to the distributing header 30, the operation of the differential regulator being based on the previously controlled pressure of the vulcanising medium and the pressure of the liquid supplied to the tube 24. A pipe 34 connects the tube 45 with the apparatus while a second pipe 35 permits the application of the pressure of the vulcanising medium thereto. A U-trap joint 36 permits the storing of a column of cold liquid which prevents the conveyance to the regulator 31 of the temperature of the vulcanising medium. A pipe 37, controlled by the valve 38, permits either the emptying of the tube 24 or the setting up therein of a continuous circulation of the liquid with which it is filled.

A member 39, identical with the member 12, is fixed to the tube 24 by a flange 40 and comprises the same detailed arrangements as the member 12 described above. A pipe 41, controlled by the valve 42 supplies the member 39 with water under pressure. An exhaust pipe 44, controlled by the valve 43, permits regulation of the supply and the pressure in the member 39.

Fig. 2 illustrates in part sectional elevation one form of the differential regulator 31 arranged for use with water under pressure and live steam as the cooling and vulcanising fluids respectively. The latter comprises a chamber 52 which is connected to the tube 24 by means of the tube 51, and a chamber 54 which is in connection with the vulcanising medium by the pipe 53. An elastic diaphragm 55 separates the two chambers; this diaphragm can deform under the influence of a difference between the pressure in the chambers 52 and 54. A shaft 56 connected to the diaphragm 55 and extending through the chamber 54 by way of a stuffing-box 57 controls the opening or closing of a compensating valve 58. As here shown a spring 59 acting between a fixed platform 61 and an adjustable plate 60 secured to the shaft 56 permits the valve 58 to be maintained slightly open to an adjustable amount with equal pressure in the chambers 52 and 54 and thus constantly to favour a small excess of pressure in the chamber 52 with respect to that in the chamber 54. By arranging that the connections to chambers 52 and 54 are reversed the pressure of the cooling fluid may be made slightly inferior to that of the vulcanising fluid when other fluids are used. A screwable junction 64 is provided in the shaft 56 for ease in assembly and a stuffing box 65 is provided round the shaft at the entry to the cooling water supply. The cooling water supply at the maximum required pressure arrives at the orifice 62 through the pipe 32 (Fig. 1) and leaves through the orifice 63 which is joined to the pipe 33 leading to the tube 24 (Fig. 1).

The functioning of the arrangement described is as follows:—

In this embodiment the differential regulator 31 is set to maintain in the tube 24, a liquid-pressure very slightly superior to that of the vulcanising medium as any small quantity of this liquid reaching the vulcanisation chamber flows away through the tube 2 and the trap 5 (Fig. 1) and therefore causes no inconvenience. This liquid is

regularly evacuated by the traps 7 and 8 (Fig. 1). The liquid contained in the tube 24 is continually cooled, partly by the cooling jacket 25 and partly by the influx of fresh liquid from the differential regulator 31. The sheath of the cable which leaves the vulcanisation tube is thus cooled while being maintained under a constant pressure during its passage along the tube 24. The length of this tube must be chosen according to the heat capacity of the cable, and its speed of travel as well as the temperatures employed. The member 39 permits the maintenance of the pressure in the tube 24 while allowing the passage of the cable. The construction and function of this device have been explained in British Patent Specification No. 505,162.

In the continuous vulcanisation apparatus as described above the vulcanisation tube is filled with saturated steam and the cooling tube with cold water under pressure; it will be appreciated, however, that the fluids used in the two compartments can be of any kind and that the corresponding constructions are within the scope of the invention.

In the case where steam is used in the vulcanising tube and compressed air or gas in the cooling tube the latter on its part being cooled by a circulation of cold water or of brine in the jacket 25 (Fig. 1), the regulator 31 will be controlled in such manner that the pressure of the air or gas is slightly inferior to the pressure of the steam.

In the case where hot water under pressure is used in the vulcanising tube and a liquid in the cooling tube, the differential regulator is to be controlled in such manner that the pressure of the cooling liquid is slightly inferior to the pressure of the vulcanising medium.

In the case where hot water under pressure is used in the vulcanising tube and gas or air under pressure in the cooling tube, the differential regulator is to be controlled so that the pressure of the cooling air or gas is very little inferior to that of the water pressure of the vulcanising means.

In the case where a hot gas under pressure is used in the vulcanising tube and a liquid or gaseous fluid under pressure in the cooling tube, the differential regulator is to be controlled so that the pressure of the cooling means is slightly inferior to that of the vulcanising means.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A method for the continuous vulcanisation of rubber articles of great length in which the article is cooled as it emerges from the vulcanisation zone by means of a cooling fluid circulating under a pressure approximately equal to the pressure of the vulcanising fluid.

2. An arrangement for carrying out the process claimed in Claim 1 in which the cooling device comprises a long tubular jacket communicating at one end with the vulcanisation jacket through a labyrinth joint and communicating at the other end with the atmosphere through a labyrinth joint.

3. An arrangement as claimed in Claim 2 in which means are provided for preventing a rise in temperature of the cooling fluid in the cooling jacket.

4. An arrangement as claimed in Claim 1 comprising a differential diaphragm regulator for maintaining the pressures of the cooling fluid and the vulcanisation fluid at approximately the same value.

5. Arrangement as claimed in Claim 4 in which the differential diaphragm regulator comprises a chamber divided into two compartments which are in connection with the vulcanisation tube and the cooling tube respectively, the two compartments being separated from each other by an elastic fluid-tight diaphragm to which is connected a spring-loaded shaft which controls the supply of cooling fluid to the cooling tube.

6. Arrangement as claimed in Claim 5 in which the differential diaphragm regulator can be set slightly to vary the feed to the cooling tube when the pressure in the two jackets is the same so as to favour a slight excess of pressure in either the vulcanisation tube or in the cooling tube.

Dated this 3rd day of July, 1945.

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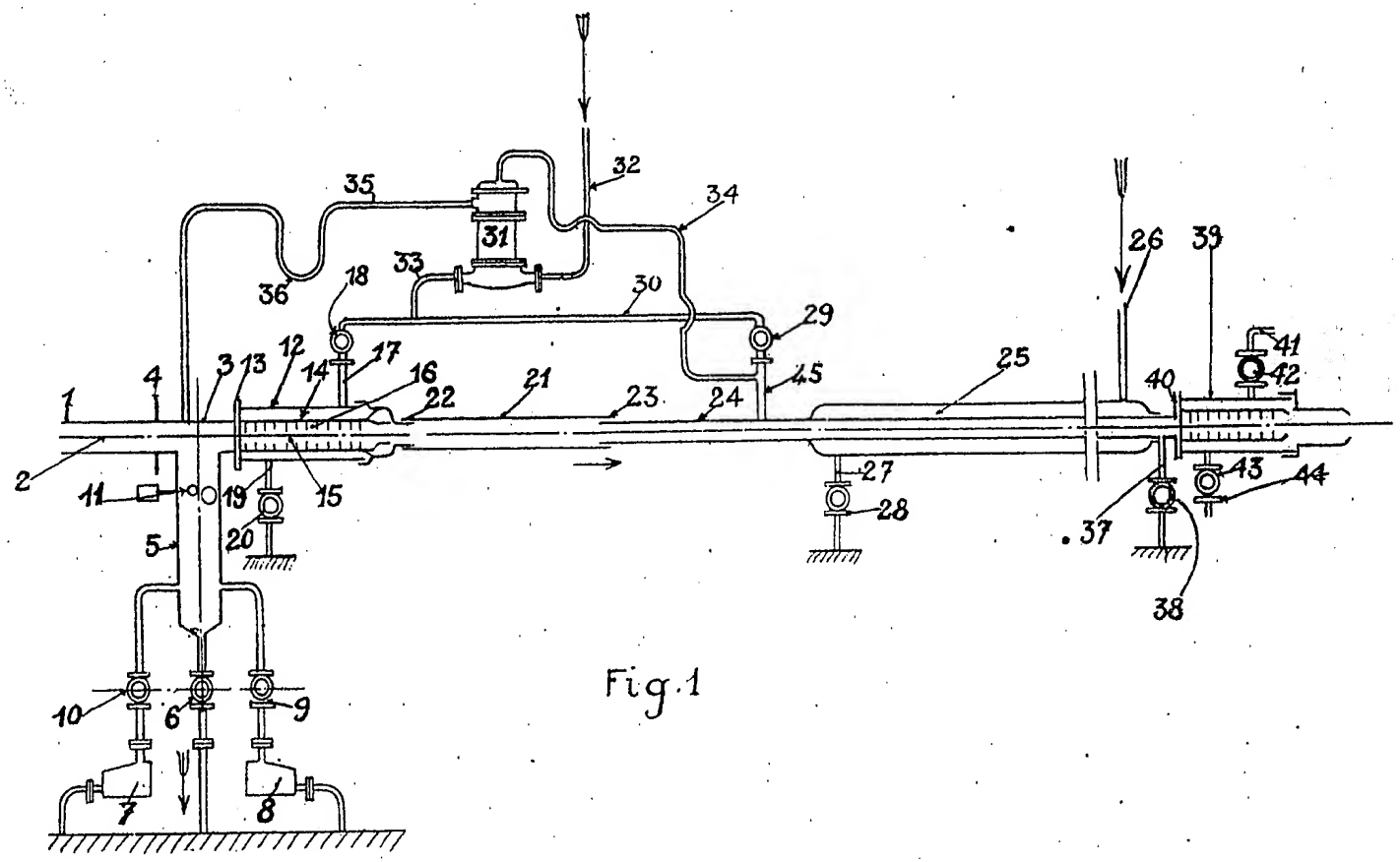

Fig. 1

621,199 COMPLETE SPECIFICATION

2 SHEETS
SHEET 1

H.M.S.O. (Ty.P.)

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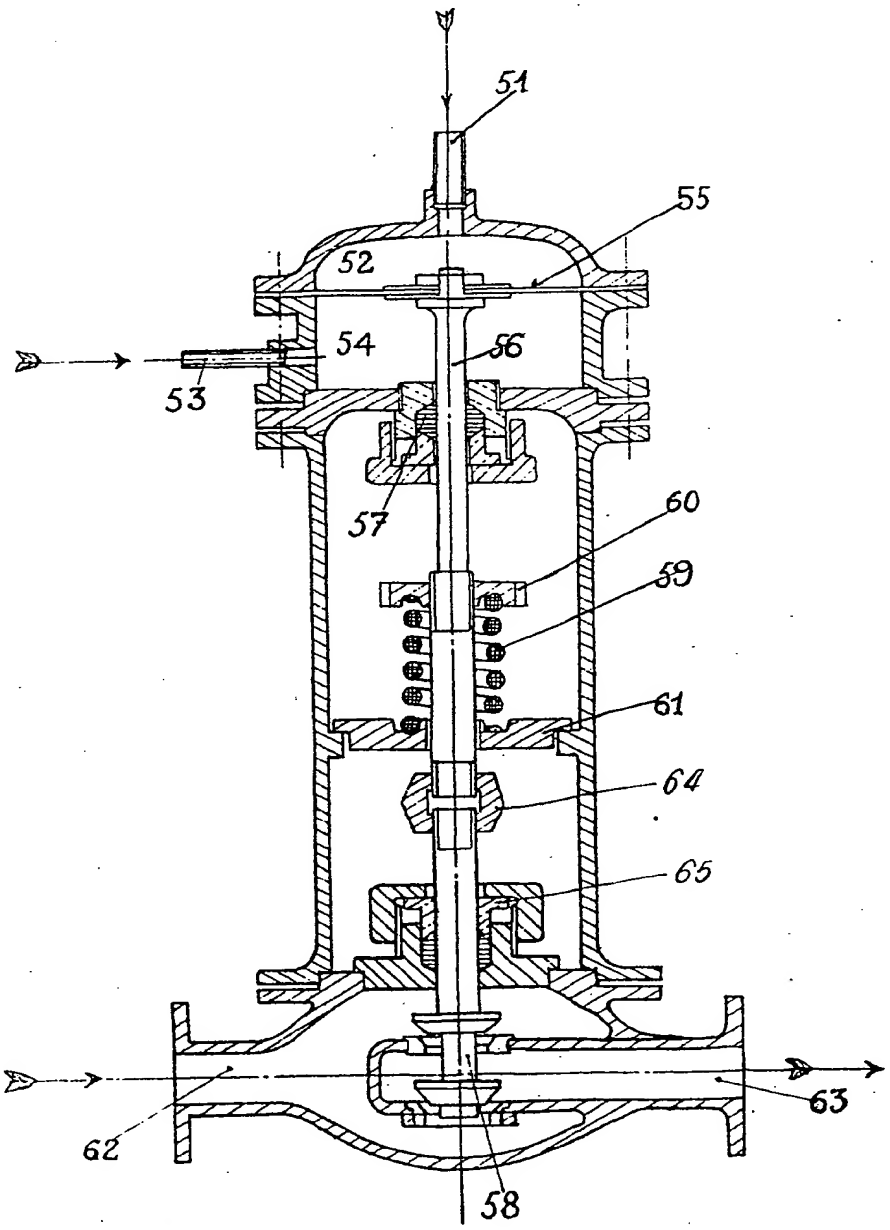
Fig. 2



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